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PISTILLODY OF PAPAYA OVULES[1]

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WITH ONE PLATE

Pistillody is a form of teratology in which some organ of a plant is replaced by a carpel. Two abnormal growths found amongst the seeds of a papaya fruit by Professor E. D. Hester proved to be well developed carpels and therefore come under this category. They were relatively large, one being 7.5 cm. and the other 5.3 cm. in length, and approximated in shape to that of a wheat grain. Further examination of the fruit from which they were obtained showed the presence of a third smaller but more nearly perfectly shaped carpel 1.5 cm. in length exclusive of stipes and style. A detailed description of the three is as follows:

Growth No. 1.—A crescentic, somewhat flattened ovary 7.5 cm. long, somewhat tapering. Cross section renate, 2.5 cm. by 2 cm. Stipes 3.5 cm. long and 1.5 mm. in diameter. The ovary was unilocular and incompletely closed, the channel on the concave side representing the line where junction should have taken place. Ovules minute and atrophied.

Growth No. 2.—More oval in shape than No. 1, 5.3 cm. in length. Cross section renate, 2.5 by 1.5 cm. The ovary was unilocular and incompletely closed. Ovules minute and atrophied except for one which was almost normal in size and protruded from the channel.

Growth No. 3.—This, at first sight the most nearly perfect carpel of the three, was solid inside with no indications of ovules. Ovary obovate-lanceolate, 1.5 cm. in length and 1.5 cm. diameter at the broadest point. Stipes 1.5 cm. long. Style 3 mm.

Normal seed (*including the gelatinous covering*)—Oval, about 7 mm. long and 5 mm. diameter.

The fruit in which these abnormalities occurred was apparently normal. No organisms were present and no mechanical injury had taken place.

The production of such growths is not rare in the Philippines, and a similar interesting case is recorded by Bergman (1) from Hawaii. Here four fruits similar in size and shape to those described above were found enclosed in a papaya fruit. Each of these contained seeds, several of which were examined and found to contain embryos.

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[1] Experiment Station contribution No. 234.

The growths described in this paper cannot be regarded as fruits as there was no seed formation. Except for one, the ovules were very small, and none contained embryos. The large one contained only a strand of vascular tissue in the middle. Bergman's paper is entitled "Intra-ovarial fruits in *Carica papaya*." This note might be entitled "Intrafructal ovaries in *Carica papaya*." Bernard (2) in describing a similar abnormality on the papaya from Java compares these bodies to the spherical body often found in oranges, which is a terminal verticel of carpels enveloped by the normal carpels.

LITERATURE CITED

(1) Bergman, H. F. Intra-ovarial fruits in Carica papaya. Botanical Gazette **72**: 97-101. 1921.

(2) Bernard, Ch. Sur une anomalie des fruits de Carica papaya. Annales du jardin botanique de Buitenzorg VII (deuxième série) 56-68. 1908.

ILLUSTRATIONS

Plate I

Figure 1. Intra-fructal ovaries and four normal seeds. Reduced.

Figure 2. The growth shown on the left of Figure 1, natural size, to show the channel. On the left is a normal seed.

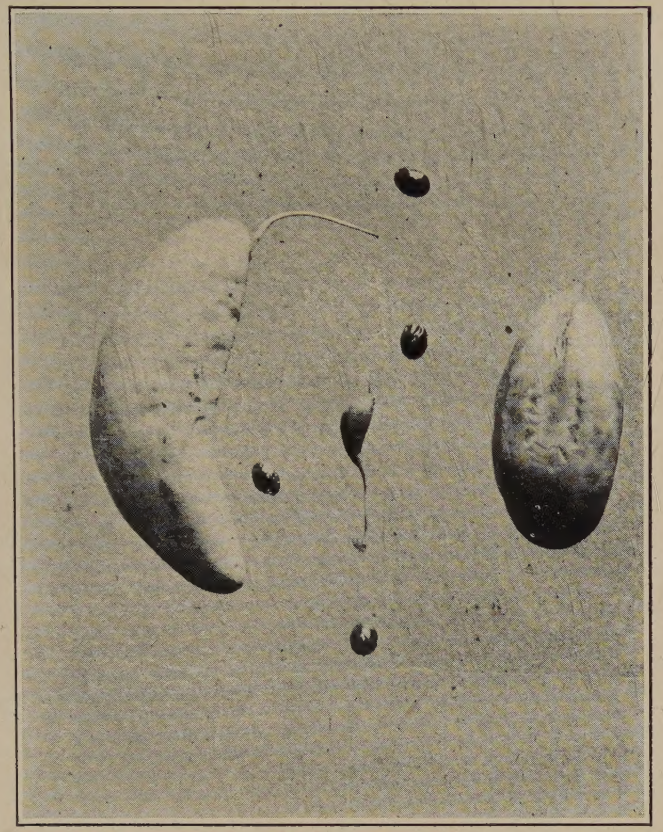

Fig. 1

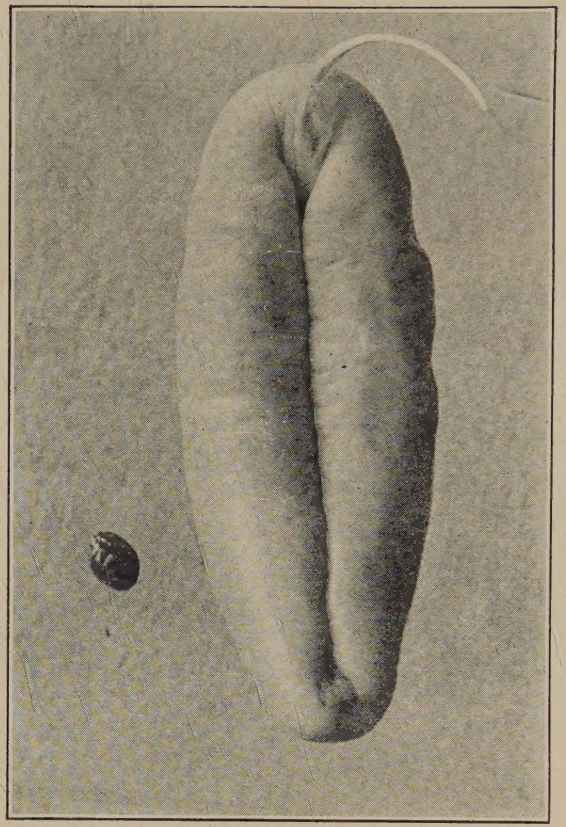

Fig. 2

PLATE I

THE EFFECT OF COPRA MEAL AS A MASH SUPPLEMENT FOR LAYING HENS[1]

By Alejo T. Taleon

WITH ONE TEXT FIGURE

INTRODUCTION

Some studies of the value of copra meal as a feed for animals have been undertaken in the Philippines and abroad. Santos (1) states that copra meal is rich in the amino-acids necessary for maintenance and growth. For guinea pigs Derecho (2) found copra meal very constipating when fed alone, but an excellent supplement to guinea grass. Fronda's (3) results show that copra meal was inferior to snails for laying hens, and less profitable for egg production. Also, more chicks died in the copra meal-fed lot than in the snail-fed lot.

On the basis of protein content, copra meal is considered cheaper than either rice bran or corn (4). Per unit of weight, copra meal contains about one and one-half as much protein as rice bran, and about twice as much as corn.

It was the purpose of this experiment to find out the effect of copra meal as a mash supplement for laying hens, that is to determine whether or not copra meal as a mash supplement favors egg production.

This experiment was conducted at the College of Agriculture, University of the Philippines, and the records cover a period of one year, from January 1 to December 31, 1920.

MATERIALS AND METHOD

Two lots of ten Native laying hens and one rooster each were used in this experiment. Of the twenty hens, fourteen were from the College flock and six were bought in the barrio of San Antonio. The fowls were from one to one and one-half years old.

The hens were separated into the two lots, Lot A and Lot B, at random as evenly as possible. The roosters were interchanged every month in order to equalize any effects that may be attributed to the males. The hens in Lot A were numbered from A1 to A10; those in Lot B from B1 to B10.

The hens were weighed on the day the experiment was begun, and were again weighed at the end of the experiment.

FEEDING

Feeds used.—The feeds used in this experiment consisted approximately of two-thirds grain and one-third mash. Both lots were fed rice and corn as grain in the proportion of one to one. The mash feed for Lot A was equal parts rice bran and corn meal, while that for Lot B was rice bran, corn meal, and copra meal in equal parts. A mixture of powdered charcoal, lime, and salt in the proportion of 1:1:1 was provided in each lot. Fresh water was provided also.

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[1] Thesis presented for graduation from the College of Agriculture, with the degree of Bachelor of Science in Agriculture, No. 185; Experiment Station contribution No. 235. Prepared in the Department of Animal Husbandry under the direction of Prof. B. M. Gonzalez.

Manner of feeding.—The mash and charcoal-lime-salt mixture were placed in a self-feeder which was made accessible to the fowls all the time. During the first month, grain was fed morning and afternoon. This feeding was found unsatisfactory as the fowls did not consume the proportional amount of the mash. From the second month to the end of experiment crumbling wet mash was fed in the morning and grain in the afternoon, dry mash remaining in the open self-feeder at all times.

HOUSING AND YARDS

The house used for this experiment is a tile-roofed structure about 2 meters high, divided by a wire partition into two equal compartments, 3.5 by 7 meters. The floor is dirt covered with sand. The walls at the sides and back are made of wood and at the front of wire netting.

There were eight trap nests for each lot.

Each lot had a grass range of 30 by 12 meters which was divided into two parts.

EGG PRODUCTION

Eggs were collected from the trap nests at noon and late in the afternoon. Unidentified eggs were credited to the respective lot as "untrapped eggs".

To secure comparative data on the weight of the eggs from each lot, eggs were weighed during April and from August to December inclusive.

After recording, the eggs of desirable shape were used for hatching and the others were sold.

BROODINESS

When the hens became broody they were immediately confined in broody coops and released on the day they showed they were broken. By giving them plenty of feed and water, broodiness was broken in 3.6 days on an average.

MORTALITY

Whenever a hen died from any cause, a hen of similar age from the College flock was substituted at once. During the progress of the experiment, three hens died and one was lost.

RESULTS AND DISCUSSIONS

Seven hens that lived through the experiment in Lot A (without copra meal) gained a total of 1322 grams and one lost 40 grams, giving a net gain of 1282 grams for the lot. In Lot B (copra meal-fed) eight hens gained a total of 2810 grams and one hen lost 63 grams giving a total net gain of 2747 grams.

The average gain per hen in this experiment was 160 grams in Lot A and 305 grams in Lot B. It is apparent that the copra meal-fed birds gained more in weight than those receiving no copra meal.

TABLE I.—*Summary table of feed consumption.*

Feed consumed	Lot A, 11 birds.		Lot B, 11 birds.	
	grain	*mash*	*grain*	*mash*
	Corn 1	Corn meal 1	Corn 1	Corn meal 1
	Rice 1	Rice bran 1	Rice 1	Rice bran 1
				Copra meal 1
Total feed (kg.)	228.4	110.7	231.2	105.8
Average per bird (kg.)	20.8	10.1	21.0	9.6

In Table I it is shown that the total grain feed consumed by Lot A was 228.4 kilograms and the total mash 110.7 kilograms, an average of 20.8 kilograms of grain and 10.1 kilograms of mash per fowl. Lot B consumed a total of 231.2 kilograms of grain and 105.8 kilograms of mash, an average of 21.0 kilograms grain and 9.6 kilograms mash per bird. There was no appreciable difference in feed consumption between the two lots.

The proportion of the feeds consumed was as follows:

	Lot A	Lot B
Corn	50.0%	44.8%
Rice	33.7%	34.3%
Rice bran	16.3%	10.4%
Copra meal	——	10.4%
Total	100.0%	99.9%

TABLE II.—*Summary of egg production by months.*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Lot A total....	50	71	85	49	58	69	85	90	61	75	54	73	820
Lot B total....	67	77	70	41	46	40	52	38	35	36	48	60	610
Lot A average per hen....	5.0	7.1	8.5	4.9	5.8	6.9	8.5	9.0	6.1	7.5	5.4	7.3	82.0
Lot B average per hen....	6.7	7.7	7.0	4.1	4.6	4.0	5.2	3.8	3.5	3.6	4.8	6.0	61.0

Table II shows the egg production for each lot. The range of egg production of the birds in Lot A was from 21 to 136 eggs, and in Lot B from 19 to 82. It is interesting to note that during the first two months of the experiment the production of Lot B was higher than that of Lot A. This might be due to the initial stimulating action of the toxic substances in copra meal (5). From the third month on, Lot A had the higher production. The total production of Lot A was 820 eggs and of Lot B, 610 eggs. There was then a difference of 210 eggs, or an average of 21 eggs per hen against Lot B. In other words, Lot B, receiving about 10 per cent of its total feed in the form of copra meal produced only about 75 per cent of the number of eggs produced by Lot A, fed the same feed but without copra meal.

The accompanying graph is plotted on the percentage basis to show this difference in egg production. The percentage of egg production is computed by dividing the total number of eggs laid by the total possible egg days, and multiplying the result by 100.

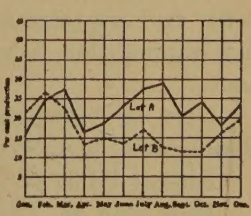

FIG. 1.—Showing the relative monthly percentage of egg production of Lot A and Lot B.

BROODINESS

Observations were made on the duration and frequency of broodiness in both lots. Nine hens in Lot A became broody 62 times, and eight hens in Lot B, 58 times. The average duration of broodiness in Lot A was 3.58 days, and in Lot B, 3.71 days. There was therefore little difference in the behavior of the two lots as regards this point.

SIZE OF EGGS

The eggs laid in April, and from August to December, inclusive, were weighed.

TABLE III.—*Summary of weight of eggs laid in six months.*

	April.		August.		September.		October.		November.		December.		Total.	
	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.
		gm.		*gm.*		*gm.*		*gm.*		*gm.*		*gm.*		*gm.*
Lot A...	49	36.6	90	37.3	61	37.1	75	38.6	54	38.7	73	39.1	402	37.93
Lot B...	41	35.7	38	36.5	35	38.8	36	37.6	48	39.8	60	40.3	258	38.34

Table III shows that there was a gradual and a fairly consistent increase in the monthly average of the weight of the eggs. The eggs from the copra meal-fed lot were slightly larger than the eggs from the lot receiving no copra meal.

Table III shows that the mean or average weights of eggs of the two lots were not very different, being 37.93 ± 0.122 grams in Lot A and 38.34 ± 0.163 grams in Lot B. The difference was 0.41 ± 0.203 grams, which is not significant.

COST OF EGG PRODUCTION

TABLE IV.—*Relative cost of egg production.*

Lots.	Grain.	Mash without copra meal.	Mash with copra meal.	Total cost.	Total No. of eggs.	Value of eggs.	Gain.
Lot A without copra meal..	228.4 kgs.	110.7 kgs.			820	₱65.60	₱34.11
Cost.....	₱20.94	₱10.55		₱31.49			
Lot B with copra meal....	231.2 kgs.		105.8 kgs.		610	₱48.80	₱17.42
Cost.....	₱21.19		₱ 9.19	₱31.38			

Table IV shows the amount of feed consumed and the total number of eggs produced in corresponding lots, respectively. In the computation of the cost of the feed consumed, the cost of the lime-salt-charcoal mixture was not included as the two lots consumed only a little of this and in about the same amount. This computation is based on the actual prices of feed at the time of the experiment:

Corn and corn meal at ₱1.00 per hundred ears, shelling, on an average, 12 kilograms, or 8.33 centavos per kilogram.

Rice at ₱4.30 per cavan (57.5 kg.), or 10 centavos per kilogram.

Rice bran at ₱3.00 for 1 cavan, approximately 28 kilograms, or 10.7 centavos per kilogram.

Copra meal at ₱70.00 per metric ton or, 7 centavos a kilogram.

Eggs sold at 8 centavos each.

By reference to Table IV, it may be seen that at prices during the progress of the experiment, the total expenses for the feed consumed in Lot A was ₱31.49 and the total value of the eggs sold was ₱65.60. In other words, there was a gain of ₱34.11 over the cost of the feeds in the operation of Lot A. The cost of the feeds consumed by Lot B was approximately the same as that of Lot A, ₱31.38. The income obtained from the eggs sold was ₱48.80, making a net gain of ₱17.42 over the cost of the feeds. There was then a difference of ₱16.69 in favor of the lot fed no copra meal.

SUMMARY AND CONCLUSIONS

This experiment was performed to test the value of copra meal as a mash supplement for laying hens receiving corn and rice as grain feed, and corn meal and rice bran as mash feed. One lot received the basic feed as above, and the other lot received copra meal amounting to one third of the mash feed in addition.

The results obtained were as follows:

1. The birds receiving copra meal gained in weight more than those receiving no copra meal.
2. There was no significant difference in the feed consumption of both lots.
3. The hens in the lot receiving copra meal produced an average of 61 eggs for the year, as against 82 eggs produced by the other lot, or a difference of 21 eggs per hen against the lot fed copra meal.
4. There was no significant difference in the size of the eggs produced by each lot.
5. There was a gain of ₱34.11 above cost of feed in the operation of the lot receiving no copra meal as against a gain of ₱17.42 in the lot receiving copra meal; a difference of ₱16.69 in favor of the lot receiving no copra meal.
6. There was no significant difference in the length and frequency of the periods of broodiness in the two lots.

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(1) Santos y Alvarez, Francisco O. A biochemical study of copra meal. The Philippine Journal of Science **16**: 181-189. 1920.

(2) Derecho, Antonio. A biological analysis of copra meal. The Philippine Agriculturist **10**: 44-54. 1921.

(3) Fronda, Francisco M. A study of the effects of animal and plant proteins in rations for laying hens. The Philippine Agriculturist **7**: 235-252. 1919.

(4) Jaffa, M. E., and Anderson, Leroy. Feeding of farm animals. California Agricultural Experiment Station Bulletin 132: 11-14. 1901.

(5) Sulit, Victor. Studies on the toxicity of copra meal. (Thesis presented for graduation for the degree of Master of Science from the College of Agriculture, 1923. Unpublished.)

SUGAR CANE BREEDING IN THE COLLEGE OF AGRICULTURE III [1]

By Nemesio B. Mendiola and Juan O. Unite
Of the Agronomy Department

The present paper is a report on the sugar cane breeding operations in the College of Agriculture for the years 1921, 1922, 1923, and the first quarter of 1924. The work from 1918-1921 was reported in three earlier papers, the first of which was prepared by Roxas (1) and the second and third by Mendiola (2 and 3). The present report does not include the results of studies made by the Plant Breeding Division of the flowering habits and flower characteristics of different varieties of sugar cane. These results will be published in a separate paper.

METHOD OF OBTAINING NEW VARIETIES

At the beginning of the sugar cane breeding work at this College, when we were still trying to learn the technique of germinating the sugar cane seed [2] and the method of handling the seedlings both in the nursery and in the field, no attempt was made to use artificial hybridization or to record parentage of the seedlings. The reason was obvious. The labor that would be invested in the details of hybridization and record keeping would all be wasted if the seeds produced in the work could not be made to germinate. However, since we learned the proper method of germination and succeeded in growing the seedlings to maturity, improvement has been introduced gradually in the work of obtaining new varieties. In the cane season of 1920-1921, and subsequently, the seedlings produced were of known parentage, at least on the maternal side. In the last season, 1923-1924, an attempt was made to cross the more important native variety Negros Purple, with the seedling variety C. A. C. 87, which is one of the most promising seedlings we produced in the first year of our breeding operations. More is said of this particular seedling variety elsewhere in this report.

New varieties have been obtained not only through sexual propagation, but also through the discovery of vegetative mutations. A constant watch is kept for the appearance of bud mutations and these are propagated for subsequent tests when found. We now have two varieties which arose as bud sports and these varieties are at present being chemically analyzed. One of these is a yellow cane and originated from Big Tanna. The other is a cane with stripings of greenish yellow and purple and was found by Mr. Gamboa of the Agronomy Department in a field of Luzon White. Previously Mendiola (2) reported bud mutations from the parent varieties Gulisan and Mauritius Malagache. But when these two mutations were grown they grew so poorly that they had to be eliminated. The authors hope to publish in a later paper the results of the tests of the mutations from Big Tanna and Luzon White field.

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[1] Experiment Station contribution No. 236.

[2] In this paper, seed is taken to mean the true seed of the sugar cane plant and not points.

CHEMICAL ANALYSES OF THE SEEDLING VARIETIES

Table I contains the results of chemical analyses made by Mr. Delfin Divinagracia under the supervision of Professor Roxas of the Sugar Technology Department. The data in Table I show the variability in sucrose content of the different seedlings and suggest the possibility of selection for high sucrose quality. The variability in fiber content and purity is also shown.

Table I shows for the year 1922 a range of variability in gravity purity of from 45.33 to 92.03. P. B. 39 is the variety which gave the 92.03 purity and partly on the basis of this showing, and partly on account of its fairly high sucrose content,—12.42 per cent of the cane,—it was selected as worthy of propagation and further tests. The range of variability in per cent sucrose in the cane, for 1922, was from 4.21 per cent to 14.07 per cent. The variety which showed a sucrose content of 14.07 per cent was P. B. 90 and this was selected for further tests. This variety gave in the same year a gravity purity of 82.67. P. B. 42, another seedling selected, gave a gravity purity of 85.12 and a sucrose content of 10.81 per cent of the cane in 1922. In fiber content, the seedlings varied from 2.99 to 16.22 per cent of cane, P. B. 90 having the 2.99 per cent and C. A. 12797 the 16.22 per cent.

The 1923 analyses showed that P. B. 39 and P. B. 42 had not only maintained their records but showed improvement. For the year 1923, P. B. 39 showed a gravity purity of 91.1 and a sucrose content of 18.08 per cent. P. B. 42 gave a gravity purity of 90.46 and a sucrose content of 14.79 per cent, and P. B. 90, 87.13 gravity purity and 12.14 per cent sucrose content. This last variety failed to show desirable cultural habits, hence is being eliminated.

CO-OPERATIVE WORK WITH OUTSIDE CANE GROWERS

This work is of two kinds: First, on the part of the College, the germinating of seeds sent by co-operators to the College and the growing and testing of seedlings raised from those seeds; Second, on the part of the outside growers, the tests and multiplication of seedling varieties sent to them. In the past we have received sugar cane seeds from the Lamao and Alabang Stations of the Bureau of Agriculture, and, more recently, from Mr. Andrés Goseco, San Fernando, Pampanga. The following letters and reports from co-operators are included in this paper to show the nature of the co-operation that is involved in this breeding operation and also as an acknowledgment of their valuable assistance in the attempt of the authors to produce sugar cane varieties suited to different localities of the Philippines.

Report No. 1.

PAMPANGA SUGAR COMPANY, LIMITED

Haciendas del Carmen, Florida Blanca, Pampanga, Del Carmen, December 15, 1922.

The Los Baños Agricultural College,
Los Baños, Laguna.

Dear Sirs:

If you have any new varieties of cane for distribution I would be much obliged if you would send me some.

The points you sent me last year, C. A. C. 1 to 85 are doing well, and three or four of the varieties are very promising indeed.

Yours very truly,
(Signed) Smith, Bell & Co., Ltd.
J. W. Wight.

TABLE I.—*Analyses of sugar cane seedling varieties.*

(*a*) *For the year 1922.*

Variety name.	Date analyzed.	Gravity purity of first expressed juice.	Percentage sucrose in cane.	Percentage fiber in cane.
P. B. 86	November 2	61.81	8.52	9.93
P. B. 83	November 24	62.92	7.85	7.86
	November 28	52.33	6.97	8.18
P. B. 91	November 29	63.61	6.27	13.07
P. B. 95	November 29	80.61	10.55	5.42
	November 4	67.06	6.46	11.02
	December 4	66.70	7.12	10.99
C. A. 16403	December 4	77.88	11.75	11.85
P. B. 73	December 4	86.02	13.95	8.45
C. A. 15969	December 4	80.48	12.47	10.91
P. B. 72	December 4	68.92	9.20	8.93
P. B. 76	December 4	84.23	12.10	13.73
P. B. 71	December 4	76.98	12.01	8.79

(*b*) *For the year 1923.*

Variety name.	Date analyzed.	Gravity purity of first expressed juice.	Percentage sucrose in cane.
P. B. 39	November 15	92.95	13.42
	December 5	91.10	18.08
P. B. 92	November 15	79.91	10.35
	December 7	82.72	11.83
P. B. 42	December 5	90.46	14.79
C. A. 14611	December 7	88.11	11.64
P. B. 90	November 15	87.13	12.14
P. B. 94	November 15	91.15	13.41
	December 7	92.16	16.59
P. B. 98	November 15	78.77	10.61
	December 7	86.49	13.32
P. B. 117	December 5	83.99	13.91
C. A. 12797	December 5	80.84	11.72
		77.54	4.92
C. A. C. 87	November 9	84.74	10.44
	Erect cane		
	December 3	82.00	9.84
	Lodging cane		
	December 3	80.02	9.87
P. B. 39	November 9	91.49	15.00
P. B. 42	November 9	88.92	12.73

P. B. 40	November 17	75.04	10.00	9.26
	November 24	75.51	9.19	10.17
C. A. 14810 or C. A. C. 14810	November 10	76.69	9.59	9.17
	November 17	79.20	9.71	9.93
	November 24	78.04	10.28	8.84
	December 7	80.98	11.15	12.90
P. B. 105	November 2	77.29	10.32	12.05
	November 10	80.58	8.98	8.88
	November 17	84.12	11.31	13.73
	November 24	82.10	10.39	12.77
P. B. 103	November 2	73.49	7.78	7.36
	November 10	64.13	7.52	14.14
	November 17	67.85	7.72	12.20
	November 24	62.38	6.24	8.96
P. B. 62	November 15	79.04	10.56	10.51
P.B. 61 or C.A.C. 98	November 15	79.25	10.42	9.77
P. B. 92	November 16	86.74	11.71	10.85
	November 23	86.13	11.24	11.64
P. B. 59 or C. A. C. 92	November 16	83.18	13.14	10.41
	November 23	83.00	13.28	7.94
P. B. 100	November 8	60.17	5.77	7.90
	November 15	64.81	5.84	5.57
	November 22	67.94	5.59	12.59
	November 29	80.15	8.95	9.32
	December 5	63.45	5.05	14.07
	December 12	66.90	6.69	3.43
P. B. 94	November 8	79.53	11.70	9.37
	November 15	85.95	12.74	9.48
	November 22	80.46	10.39	13.56
P. B. 93	November 8	74.93	7.62	8.78
	November 15	77.57	7.51	7.04
	November 22	70.19	6.46	7.26
C. A. 14806	November 8	78.31	8.83	10.79
	November 15	80.51	8.12	11.39
	November 22	81.25	10.27	11.00
P. B. 101	November 8	84.06	12.12	5.09
	November 15	80.91	9.72	12.42
	November 22	88.42	12.24	12.66
P. B. 39 or C. A. C. 88	November 10	92.03	12.42	6.57
	November 17	84.63	10.46	9.51
P. B. 42 or C. A. C. 89	November 10	79.82	9.01	10.12
	November 17	85.12	10.81	10.57
P. B. 57 or C. A. C. 93	November 18	80.53	11.67	7.14
	November 25	80.24	10.11	13.09
P. B. 52 or C. A. C. 91	November 18	77.59	11.03	7.12
	November 25	74.59	10.41	9.60
P. B. 41 or C. A. C. 90	November 18	78.55	10.75	12.01
	November 25	81.08	10.95	10.48
P. B. 83	November 24	62.92	7.85	7.86
	November 28	52.33	6.97	8.18
P. B. 91	November 29	63.61	6.27	13.07
P. B. 95	November 29	80.61	10.55	5.42
	November 4	67.06	6.46	11.02
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C. A. 15969	December 4	80.48	12.47	10.91
P. B. 72	December 4	68.92	9.20	8.93
P. B. 76	December 4	84.93	12.10	13.73

Report No. 2.

CALAMBA SUGAR ESTATE
Canlubang, Laguna Province,
PHILIPPINE ISLANDS

November 27, 1922.

Dr. Nemesio Mendiola,
College of Agriculture,
Los Baños, Laguna.

Dear Sir:

In reply to your letter of November 20th, we herewith send you a copy of our Mr. Pritchett's report which is self-explanatory, and which will undoubtedly give you all detailed information regarding the cane mentioned. Apparently the results show very well.

We are propagating and distributing this cane as fast as possible. We hope that you are keeping up this good work which will undoubtedly give some very satisfactory cane adapted to the conditions in the Philippine Islands.

Very truly yours,

CALAMBA SUGAR ESTATE.
(Sgd.) L. WEINZHEIMER,
Vice-President.

Report No. 3.

November 25th, 1922.

Vice-President:

Sir:

In reply to Dr. Mendiola's communication regarding the agricultural characteristics of 1, Malmont, and 2, 651286, I may say these two canes together with 14,254 were selected by myself from some 60 varieties on account of their very fine growth and stooling qualities, also their apparent ability owing to being deeprooting varieties to withstand exceedingly dry weather conditions. Analyses of the juices confirmed the potentialities of these varieties on our stiff clay soils and encouraged me to plant out as extensively as the limited supply would allow, and also distribute small quantities to the several sections for further propagation and distribution.

Malmont is a yellowish brown cane with nodes some 3 to 3½ inches in length. The joints being barrel shaped; the eyes full and heavy. The cane is *recumbent* with a very broad bladed leaf, of a dark green color; it is very soft and juicy and stools very freely and is of robust growth, the diameter of the stalk being 1¼ to 1½ inches. A small quantity was planted in Mañgumit, 0.02 Hectare, and we have about 0.04 hectare in the Experimental plots.

Analysis of juice is as follows:

Brix.	Pol.	Purity.
20.2	19.0	94.5

I hope to cut back and plant as much as possible of this variety and distribute any surplus to the several sections.

651286 is a reddish yellow cane, upright, with Spiky Eight green leaves, not unlike D. 1135 and I would not be surprised to learn it is a seedling of this variety; it has long joints which are grooved, the eyes are small and hard, and the cane is likewise very hard.

This cane stands dry weather exceedingly well and stools very freely both as Plant and Ratoons. When young this cane has a very distinctive red point to the leaf extending for an inch or more downwards. It is a rapid grower and is doing very well at present. We have 0.6 Hectare in the Experimental Plots, 0.2 at Mañgumit, 0.2 at Calamias and I have sent several sacks to Mr. Dumas at Calawan who reports favorably on it.

I will likewise cut back this variety and further distribute same. Analysis of the juice as obtained from the Mill Laboratory is as follows:

Brix.	Pol.	Purity.
20.0	19.2	95.4

14254. This is a very heavy leafed green cane of comparatively short stature and very thick in growth with large flat eyes. I had little of this cane, but was greatly impressed with its healthy

growth and stooling capabilities. The ratoons of this variety are fulfilling my expectations, the stooling being remarkable, after 10 weeks of growth this variety has very nearly shaded in on a 5 feet Cane Row. No distribution was made of this cane on account of shortage. It is a soft, juicy cane and analysis is as follows:

Brix.	Pol.	Purity.
19.0	16.0	84.2

Yours,

(Sgd.) G. H. PRITCHETT,
Division Overseer.

True Copy from the Original.

Report No. 4.

CALAMBA SUGAR ESTATE

Memo. for Main Office:—

Analyses of juices expressed by Laboratory mill from canes submitted by Experiment Station:

	Brix	*Pol.*	*Purity.*
Plot 13 Variety unknown.....	17.0	15.2	89.4
Plot 13 Variety unknown.....	18.0	15.6	86.7
Variety 651286.....	20.0	19.2	95.4
Variety 16832.....	17.7	16.2	91.5

(Sgd.) .....
Factory Superintendent.

Memo. No. 28.
Dec. 23, 1921.

Report No. 5.

Factory Superintendent
C. S. E.

Analyses of juices expressed by Laboratory mill from sample of cane received from Experiment Station on December 28, 1921.

Badila.....	Brix.	17.7	Pol.	14.8	Purity	83.6
Malmont.....	"	20.2	"	19.0	"	94.5
Otomato.....	"	16.3	"	13.9	"	85.3

(Sgd.) ED. ROBERTS,
Chemist.

Dec. 29th, 1921.

Report No. 6.

January 3rd, 1922.

Factory Superintendent,
C. S. E.

Analyses of juices expressed by Laboratory mill from sample of cane received from Experiment Station on January 2nd, 1922.

Big Tanna.....	Brix.	16.2	Pol.	12.8	Purity	79.0
Green Goru.....	"	19.0	"	16.7	"	87.9
Imperial Striped Cheribon.....	"	15.8	"	12.6	"	79.8
Hambledon 426.	"	18.5	"	16.7	"	90.2

(Sgd.) ED. ROBERTS,
Chemist.

Report No. 7.

January 25th, 1922.

Factory Superintendent,
Calamba Sugar Estate.

Analyses of juices expressed by Laboratory Mill from samples of cane received from Experiment Station on January 26, 1922.

Sample.	*Brix.*	*Pol.*	*Purity.*	*Remarks.*
12730	20.7	14.7	71.1	Variety
14798	22.2	15.5	69.9	"
16821	18.5	16.2	88.6	"
14721	23.4	15.5	66.8	"
13814	19.7	17.2	87.3	
16721	18.7	12.1	64.7	"
Rose Bamboo	19.2	17.2	89.6	
14567	19.6	16.6	84.7	
14794	15.5	12.8	82.6	
12900	19.6	17.2	87.8	
13660	18.5	15.8	85.5	
12839	16.9	14.2	84.0	

(Sgd.) .....
Chemist.

Report No. 8.

January 28th, 1922.

Factory Superintendent,
Calamba Sugar Estate.

Analysis of juices expressed by Laboratory Mill from samples of cane received from Experiment Station on January 27th, 1922.

Samples.	*Brix.*	*Pol.*	*Purity.*	*Remarks.*
Rose Bamboo	19.2	17.2	89.6	
14567	19.6	17.0	86.7	Variety
14794	15.5	12.8	82.6	"
12900	19.6	17.3	88.3	"
13660	18.5	15.8	85.5	"
12839	16.9	14.2	84.0	"
12730	20.7	14.7	70.6	"
14798	22.2	15.5	69.9	"
16821	18.3	16.2	88.6	"
14721	23.4	15.5	69.3	"
13814	19.7	17.3	87.8	"
16721	18.7	12.2	65.3	"
12738	19.9	16.2	81.4	"
14830	16.0	12.0	75.0	"
12843	17.6	15.3	86.9	"
14259	18.8	15.8	82.5	"
13815	19.7	15.0	86.3	"
14832	18.9	15.2	80.5	"
14018	21.1	15.6	74.0	"
12750	17.7	11.3	63.9	"
16700	17.1	11.1	64.9	"
14440	22.7	15.9	70.1	"
16776	17.1	12.5	73.5	"
14801	13.6	9.4	69.1	"
12729	18.9	15.9	84.2	"
12732	16.5	10.7	64.9	"
12749	17.7	11.1	62.7	"
14790	14.7	12.2	83.0	"
14799	15.7	13.7	87.3	"
14254	19.0	16.0	84.2	"
13264	19.5	16.0	82.1	"
16802	19.7	12.4	62.9	"
13568	21.7	15.8	72.9	"

(Sgd.) .....
Chemist.

Report No. 9.

Apalit, Pampanga.

Dr. N. B. Mendiola,
Los Baños College,
Laguna.

I would like to take this opportunity to make a report on the C. A. C. 110 cane points which you sent me last year. On account of the flood that we had and because when the rainy season came the plants of your C. A. C. 110 seedling were still young, some of them died. Those that remained grew very tall, but they were not heavy stoolers. This year I planted them again. I now have seven rows of it, planted side by side with my native sugar cane points.

Yours sincerely,

(Sgd.) J. J. Gonzalez.

Report No. 10.

San Fernando, Pampanga,
Enero 23, 1923.

Dr. N. B. Mendiola,
College of Agriculture,
Los Baños, Laguna.

Muy señor mío:—

De las variedades que Vd. me envió el año pasado, tuve que eliminar juntamente con Mr. Lee del Buró de Ciencias algunas variedades porque han sido afectadas por la enfermedad llamada "mosaic". La única variedad que no se ha encontrado ninguna enfermedad completamente nada, son el Badila y la Louisiana Striped y la variedad creada por Vd. ó sea el C. A. 12797.

De usted respetuosamente,

(Fdo.) Ricardo Ocampo.

Report No. 11.

(Test of seedlings for forage uses)

The Government of the Philippine Islands
Department of Agriculture and Natural Resources
Bureau of Agriculture

Alabang Breeding Station,
January 6, 1922.

Sir:

I have the honor to inform you that out of eight varieties of forage canes you brought to this station last January, 1921, only two, C.A. 13215 and another unnamed variety, seem to have some qualities of a good forage cane. However, it is intended that all these varieties will be planted and tried again this year for further observation. Some remarks about these canes are herewith furnished you.

Very respectfully,

(Sgd.) Assistant in Agronomy.

Dr. Nemesio B. Mendiola,
Consulting Plant Breeder,
Los Baños, Laguna.
Through the Director of Agriculture,
Manila, P. I.

Report No. 12.

The Government of the Philippine Islands
Department of Agriculture and Natural Resources
Bureau of Agriculture
Manila

May 24, 1924.

Sir:

In reply to your letter of April 7, 1924, addressed to the Chief, Plant Industry Division of this Bureau, I have the honor to inclose herewith a copy of the report on the analysis of the seed-

ling varieties of sugar cane obtained from the College of Agriculture and tested at our La Carlota Experiment Station, La Carlota, Occidental Negros.

Very respectfully,

(Sgd.) Don D. Strong,
Acting Director.

Dr. Nemesio B. Mendiola,
Associate Professor of Agronomy.
(Through the Dean,
College of Agriculture,
Los Baños, Laguna.)

Seedling varieties of sugar cane obtained from the College of Agriculture.

There were 13 sugar cane seedling varieties at the La Carlota Experiment Station obtained from the College of Agriculture at Los Baños. The C. A. C. 86 was received November 11, 1922, and planted on the next day. The C. A. C. 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, and 98 and C. A. 12797 were received later, December 5, 1922, and were planted December 6, 1922. All of these were planted in the Acclimatization plots of the Station. The per cent germination was poor, so some of them had only one or two stools. The C. A. C. 97 had two stools growing, but at about the beginning of the month of May of 1923 they wilted and finally died.

During the later part of October, 1923, it was observed that the variety C. A. C. 94 had a stalk infected with Mosaic disease. This was the only one observed to have the disease while the others were found healthy without any disease. On the month of November, 1923, all have arrowed with the exception of C. A. C. 92, C. A. C. 96, and C. A. C. 86.

From December 11 to 13, 1923, the canes of each variety were harvested. The stalks were made into cuttings and planted into the Sugar Cane Nursery of the Station. Samples were however taken for analysis.

The following table will show the results obtained:

Age of cane M	Variety name	Ave. Wt. stalk K.	Correct brix.	% Sucrose	App. purity	Acidity N/10	% Fiber in cane
12	C.A.C. 88	.68	11.44	8.52	74.3	5.4	14.32
12	C.A.C. 93	.91	17.23	14.68	85.4	3.4	11.69
12	C.A.C. 95	1.07	13.93	11.66	84.1	4.0	11.16
12	C.A.C. 96	2.17	17.33	15.09	87.2	3.4	10.85
13	C.A.C. 86	1.47	19.60	15.45	79.0	2.0	11.94
12	C.A.C. 98	1.24	13.04	10.42	80.0	4.2	15.30
12	C.A.C. 94	.84	17.03	14.51	85.2	2.7	9.48
12	C.A.C. 89	.96	17.83	16.11	90.4	3.2	12.87
12	C.A.C. 90	.89	14.63	12.54	86.1	3.3	13.72
12	C.A.C. 12797	.85	14.93	10.96	73.5	7.7	19.53
12	C.A.C. 91	——	——	——	——	——	——
12	C.A.C. 92	——	——	——	——	——	——

The samples corresponding to C.A.C. 91 and 92 were spoiled.

A true copy.
(Sgd.) Rafael Asprer,
Chief Record Section.

NUMBER OF SEEDLINGS RAISED YEARLY

In the first year of this work more than 10,000 seedlings were raised. Of these, nearly 6,000 were eliminated before they reached maturity. When the rest matured it became a problem at once to know how they could all be multiplied or, if some of them had to be eliminated, what method was to be used in the selection of seedlings for further propagation. Because of this and related problems, it was necessary in subsequent years to limit the number of seedlings to be raised, as in each year of the work there were the new seedlings to be taken care of besides the seedlings produced and saved the preceding years. After more than four years of work, even with limiting the number of seedlings raised

each season, this cane breeding operation has absorbed so much of the activities of the Division of Plant Breeding that several projects involving other crops had to be abandoned. This year the Division is fortunate in having received from the College a Bausch & Lomb Abbe refractometer. With the aid of this apparatus it probably will be very much easier to make the preliminary selection of varieties; hence it may be possible to increase the number of seedlings, unless other problems not anticipated should arise.

With a view of being able to make selections of the desired seedlings as early as possible, the authors are at present studying the asexual inheritance of the stooling habit of very young, as well as mature, seedlings. It might be assumed that such a habit, if free from the effects of environment, is perpetuated in vegetative propagation. However, we have at present no means of telling how much of the stooling habit of newly grown or of mature seedlings is the effect of environment while they were still in the seed flat, in pots or in the field. This study is now in its second year.

PROMISING VARIETIES SO FAR SELECTED

To date, out of about 14,000 seedlings raised in this College, six have been selected as promising. Two of these were selected by the Calamba Sugar Estate and bear our numbers C. A. C. 111 and C. A. C. 112 but known in Canlubang under our preliminary numbers C. A. 651286 and C. A. 14254, respectively. The others which are our own selections bear the following designations: C. A. C. 87, C. A. C. 88, C. A. C. 89 and C. A. 12797. Notes on these six varieties follow:

THE C. A. C. 111

We are indebted to the Calamba Sugar Estate for the propagation, tests, and final selection of this seedling variety. It is a medium sized cane, yellowish red, erect in habit of growth, a good stooler and with small though otherwise vigorous buds. In December, 1921, it gave 20.0 Brix, 19.2 Pol. and 95.4 Purity in Canlubang. In November, 1922, this variety was already occupying an aggregate area of more than one hectare. At the Laguna Provincial Fair held in Los Baños on May 24-31, 1924, this was one of the several College seedlings exhibited by the Calamba Sugar Estate.

THE C. A. C. 112

The Calamba Sugar Estate was responsible, also, for the propagation, chemical tests, and final selection of the C. A. C. 112. This variety is a smaller and shorter cane than C. A. C. 111; is a green cane, heavy leafed, a very good stooler and possessing broad thin buds. In December, 1921, Canlubang found it to give 19.0 Brix, 16.0 Pol. and 84.2 Purity. This variety was also exhibited by the Calamba Sugar Estate at the Laguna Provincial Fair.

THE C. A. C. 87

This is a medium sized cane, very long jointed, hard and erect. The stalk is reddish when young but the red color gradually disappears as the plant becomes older. At maturity the stalk is yellow with some patches of slight red remaining. This variety was selected for its vigorous growth habit, its hardy qualities, resistance to the serious diseases found on the Philippine standard varieties, and its resistance to the bending effect of typhoons. The last culture of this

variety, when the cane was one year old, was caught by a strong typhoon which lasted for three successive days, but it recovered quickly from the lodging effects, not even remaining sprawling. It recovered faster and to a greater extent than either the Luzon White or Negros Purple.

Chemical analyses.—The following results, contained in Table II, of analyses made at different dates and in different years by the Sugar Technology Department show the possibilities of this variety as regards sugar cane content.

TABLE II.—*Chemical analyses of C. A. C. 87 variety.*

	Dates of analyses.		
	Nov. 2, 1922.	Nov. 9, 1923.	Dec. 3, 1923.
Percentage of sucrose in cane.....	7.22	10.44	9.85
Gravity purity of first expressed juice.....	84.29	84.74	81.01
Quality ratio.....	1:15.6	1:10.6	1:11.8
Percentage of fiber in cane.....	12.15		

The following formula, which was furnished by Professor Roxas, was used in determining quality ratio:

$$\text{Quality ratio: } = 1:\frac{100}{\left(\text{Per cent sucrose in cane}\right) \times \frac{96}{100} \times \frac{97.5\,(b-38)}{b\,(97.5-38)} \times \frac{100}{96}}$$

In this formula b is the purity of the juice, 97.5 the purity of sugar, 38 the average gravity purity of final molasses in Philippine Centrals, 96 the percentage of extraction and the other 96 the polarization of sugar.

In connection with the above analyses, it is believed that they do not necessarily show the limit of possibilities of this variety as the crops involved were planted in November, which is out of season, and consequently were harvested out of season. This opinion is confirmed by Professor Roxas. The 1924 field was planted on time and it is anticipated that this crop will give better purity and sucrose content.

Tonnage.—It seems now that the most important point which remains to be determined for this variety is the tonnage in cane or in sugar. The authors will be able to say something definite on this point after the 1924 planting is harvested. This variety now occupies nearly a hectare of ground all of which is planted to points alone. The previous cultures were almost valueless material for tonnage determination because they were on a small scale, and the seeds were mixtures of points and stalk cuttings and were planted primarily for propagation purposes. There are indications however that this variety will give a better tonnage than the Luzon White, especially under conditions in which Luzon White would not thrive well. The ratoon plant of C. A. C. 87 is a very heavy stooler, much heavier than Luzon White or even Negros Purple.

Diseases.—Doctor Ocfemia who is in charge of the plant disease work in this College furnished the authors with the following information in answer to their request: "Your sugar cane variety C. A. C. 87 has only *Bakerophoma sacchari* Died., *Sclerotium rolfsii* Sacc., and another leaf spot which can not be determined at present on account of absence of spores. All of these three diseases, caused by the fungi named above, are only mild. You do not have the rust and the Cer-

cospora leaf spot yet. Neither do you have the Fiji disease. This does not mean, of course, that the variety is resistant to the more serious cane diseases. That still remains to be seen." The authors might add that since this variety was first raised in 1921, no mosaic has been found on it, although in several cultures it was surrounded by mosaic infested canes. Furthermore, neither the ratoon cane nor the plant cane of this variety has shown any cane smut attack, although the last culture was on land which in previous years was occupied by smut infected canes. However, because this variety shows several Uba cane characteristics and because the Uba cane is notoriously susceptible to cane smut, an arrangement has been made with Doctor Ocfemia by which an experiment on artificial inoculation with smut will be made this year.

The 1924 plant cultures of this variety cover about one hectare of ground on the College of Agriculture Farm while 15 sacks of cuttings were sent to a co-operator in Apalit, Pampanga, for outside test. We have also several hundreds of seedlings this year which are supposedly hybrids between this variety and Negros Purple. Several requests for this variety remain unfilled for lack of points.

THE P. B. 39, OR C. A. C. 88

This seedling variety has a medium sized stalk, leafy and red in color. It has a yellow root band and fairly prominent buds. Selected originally for high purity and sucrose content alone, it has now shown another desirable quality, that of being resistant to after maturity deterioration.

Chemical analyses.—Table III shows the results of analyses of this variety.

TABLE III.—*Results of analyses of C. A. C. 88 variety.*

	Dates of analyses.				
	Nov. 10, 1922.	Nov. 17, 1922.	Nov. 9, 1923.	Nov. 15, 1923.	April, 1924.
Percentage of sucrose in cane	12.42	10.46	15.00	13.42	15.1
Gravity purity of first expressed juice	92.03	84.63	91.49	92.95	89.1
Quality ratio	1:8.3	1:10.6	1:6.9	1:7.5	1:7.05
Percentage of fiber in cane	6.59	9.51	——	——	14.0

This variety surprised the authors when at the advanced age of 16 months it gave 89.1 purity and 15.1 per cent of sucrose in the cane. The yield in cane was 3.605 tons in about 1150 square meters. This is equivalent to 31.33 tons per hectare.

THE P. B. 42 OR C. A. C. 89

This variety is much like C. A. C. 88 except that it is a yellow cane and its buds are less prominent.

Chemical analyses.—Table IV contains the results of analyses of this variety.

TABLE IV.—*Results of analyses of C. A. C. 89 variety.*

	Dates of analyses.			
	Nov. 10, 1922.	Nov. 17, 1922.	Nov. 9, 1923.	April, 1924.
Percentage of sucrose in cane	9.01	10.81	12.73	14.95
Gravity purity of first expressed juice	79.82	85.12	88.9	90.3
Quality ratio	1:12.9	1:10.2	1:8.4	1:7.06
Percentage of fiber in cane	10.12	10.57	——	——

In the same season, Luzon White, ratoon, gave a quality ratio of 1:8 .18.

The cane yield was 4.028 tons in 1428 square meters of ground. This is equivalent to 28.21 tons per hectare. At the La Carlota Station in December, 1923, at the age of 12 months, C. A. C. 89 gave 16.11 per cent sucrose, 90.4 purity and 12.87 per cent fiber in cane.

Both the C. A. C. 88 and C. A. C. 89 have not shown any serious disease. They were both planted in Sta. Barbara, Pangasinan, for trials in that place.

THE C. A. 12797

This variety is very much like the C. A. C. 87 except that it has somewhat broader leaves and a more slender stalk.

Chemical analyses.—Table V gives the results of analyses of this variety.

TABLE V.—*Chemical analyses of C. A. 12797 variety.*

	Dates of analyses.			
	Nov. 2, 1922.	Nov. 9, 1922.	Nov. 16, 1922.	Nov. 9, 1923.
Percentage of sucrose in cane..	6.22	5.72	8.49	8.01
Gravity purity of first expressed juice.....	71.42	62.20	67.44	77.54
Quality ratio.....	1:19.6	1:27.9	1:16.4	1:14.9
Percentage of fiber in cane . . .	14.12	16.22	13.61	

This variety grown at the Pampanga Sugar Mills gave in 1921, at the age of ten months, 11.49 per cent sucrose, 77.64 purity and a quality ratio of 1:12.3 (Mendiola, 2). At the La Carlota Station in December, 1923, at the age of 12 months, this variety gave 10.96 per cent sucrose, 73.5 apparent purity and 19.53 per cent fiber.

It will be observed from the above data that the C. A. 12797 has rather a low sucrose content and low purity. This variety was originally selected for its high resistance to diseases and it was intended that, should it prove absolutely resistant to the serious diseases of Philippine canes, this quality could later be combined with high sucrose content by hybridization. That it is resistant to the serious cane diseases is shown by the reports from co-operators in Pampanga and by the observations made on the cultures in the College grounds. Despite this showing, however, it is likely to be abandoned or eliminated entirely in our work since the C. A. C. 87 shows better sucrose content and purity and is equally resistant to diseases. It was the C. A. C. 87, in fact, that was crossed with Negros Purple, and not the C. A. 12797. For purposes of comparisons, Table VI, containing the results of analyses of plant canes of Negros Purple variety, is included.

TABLE VI.—*Results of analyses of plant canes of Negros Purple 1923-1924. (Furnished by Mr. Gamboa).*

Plot.	Treatment given to plot.	Size of plot.	Yield of cane.	Purity of first expressed juice.	Percentage sucrose in cane.	Quality ratio.
	$(NH_4)_2SO_4$ *in kg.*	*sq. m.*	*tons*			
A.....	120	1250	7.270	88.2	15.68	1:6.85
B.....	240	1250	3.475	87.9	16.03	1:6.70
C.....	none	1250	4.385	83.1	15.53	1:7.24
D.....	360	1250	5.300	87.2	16.18	1:6.69

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(2) Mendiola, N. B. Breeding new sugar cane varieties at the College of Agriculture. The Sugar Central and Planters' News **1**: (No. 13) 1-13. 1920.

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A VIABILITY TEST FOR SOME TROPICAL SEEDS[1]

By Andres Tolentino

INTRODUCTION

NATURE OF THE PROBLEM

The problem involved in this work is not to determine longevity of seeds; it is an attempt to find out whether viability of some tropical seeds can be tested by the use of potassium hydroxide solutions. There are many germination tests already in use, but the methods employed are very different from the one dealt with in the present work. The method employed in this experiment is short and should have great practical importance in agriculture.

BEARING AND IMPORTANCE

Testing viability of seeds is important since seeds constitute by far the most variable material the farmer has to purchase. The entire success or failure of a crop may be wholly determined by the kind or condition of the seed sown. The cultural value or actual planting value of seed is determined by its germination percentage. The farmer having determined the viability of his seeds before planting is in possession of a highly essential factor in crop production. Experience has demonstrated to many farmers that the only feasible course for them to follow in the purchase of seeds is the testing of their viability before purchase.

Germination tests reveal the presence of old seed which may have been mixed with new seed as a means of disposing of the former, and they also give the percentage of strong seeds, which can be used as a guide at seeding time. It should be of interest to know an easy and short method of viability test in order to save time and labor in testing.

REVIEW OF LITERATURE

The references in this work are included in general reports and in various special papers on other subjects concerning viability of seeds and germination tests.

In spite of the importance and practicability of seed testing to agriculture, there has been no work done in this College concerning methods of viability testing of seeds other than by means of germination, so far as the writer knows. In the Philippines seed testing is not commonly practiced by the farmers as in the United States and other countries. There are various methods of testing viability which have proved to be of great practical value.

Munn (1) advocates the rag doll method of testing seed of corn, and claims it to be the cheapest, most accurate and convenient to use of any tester known. Pammel and King (2) report that in Iowa State College of Agriculture seeds were germinated in petri dishes in which sterilized moistened filter paper had been placed. Jagger and Stoddard (3) report three methods of testing; (a) a cutting

[1] Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture No. 186; Experiment Station contribution No. 237. Prepared in the Department of Plant Physiology under the direction of Professor D. A. Herbert.

test which determines quickly the percentage of seed that are filled but in no wise tells the percentage that have vitality enough to sprout; (b) a germinator test in which the seeds are kept under the most ideal conditions for germination; (c) a soil test that usually gives the percentage of germination but in a longer time than the germinator test. Tillman (4) recommends blotting paper as a satisfactory material for testing the germinability of seeds, especially for the smaller ones. Oetken (5) reports that in trying to test the value of field soil as a medium for making germination tests of seeds, he placed wheat kernels in loam, humus, and clay soils at 2, 3, and 4 centimeters depth; the soils ranged from 5 to 15° C. in temperature and from 40 to 70 per cent saturation. The results were inconclusive. Pittauer (6) reports a study of color variation in black pine seed with special reference to the influence of color on the germinative value of seeds. Pieper (7) in his endeavor to find a method that would give results in germination tests that would run parallel to field conditions, tested oats, wheat, white mustard, lupine, and sainfoin by a method in which the seeds were covered with 3 centimeters of either quartz sand, heavy clay, brick dust, sandy loam, or humus soil. Quartz sand gave the most satisfactory result, as by it, not only the viability, but also the vegetative strength of the seed would be determined. Johnson (8) advocates a method of estimating the vitality of seeds by electricity, in which the blaze current is used as the indicating factor. Walter (9) reports that .03 or .04 volts indicate a high class seed of which 97 per cent germinated. He says this is quicker than any other germination test. Bolley (10) reports a test with hard clover seed treated with 0.1 per cent caustic potash solution for one hour, at 80° C. for 1 and 2 minutes, and 70° C. for 1 minute, that showed that neither the untreated seed nor any of the treated samples succeeded in producing as many plants in the field as the samples produced sprouts in germination tests. He claims that the highest percentage of field growth was 61.7, while the average of 40 tests in the laboratory showed 77 per cent. Lesage (11) describes a method for determining the germinative ability of seeds by placing them in solutions of caustic potash. Varying dilutions of a normal solution were used, and for different kinds of seeds; it was found that the strength of the solution had to be varied. He states that non-viable seed was found to discolor the solution within a few hours, while sound viable seed did not. This method was worked out for the seed of cress, but it has been tested on a number of other kinds of seed and found to apply to many of them.

This method suggested the work reported in this paper.

OBJECT OF THE PRESENT WORK

The objects of the present experiment were: (a) To determine whether potassium hydroxide solutions is a reliable test for the germinative faculty of some tropical seeds; and (b) To determine which part or parts of the seed are responsible for the discoloration of the solution.

TIME AND PLACE OF THE PRESENT WORK

The work here described was carried out in the Department of Plant Physiology of the College of Agriculture, during the College year June, 1923—February, 1924.

MATERIALS AND METHODS

Commercial caustic potash and rain water were used in the preparation of the potassium hydroxide solutions of the following concentrations: 0.025 N, 0.05 N, 0.1 N, 0.2 N, 0.3 N, and 0.4 N.

Most of the seeds used (Table I) provided by from the Department of Agronomy, but some of them were obtained from private farmers. There were fourteen kinds of seeds used and they were tested separately. In every test, only seeds of the same kind were used. In order to carry out the test, one seed was put in each of six hundred small vials. The potassium hydroxide solutions were applied separately to every 100 seeds in every 100 vials. The solution put in every vial was enough to cover the seed; the solution was dropped in with a medicine dropper. Time was recorded as soon as any of the solutions was applied and the number of seeds that discolored the solution were observed for three hours, at thirty minutes interval.

All the seeds after immersion in potassium hydroxide solution were germinated in saw dust to test their germinative faculty. In the germinating boxes the seeds that discolored the solution were separated from those that did not. One hundred seeds of each of the fourteen kinds of seeds were not immersed in any of the solutions, but were germinated in saw dust for the control. All germination tests were made outside the laboratory.

To determine which part of the seed was responsible for the discoloration of the solution, the seed coat of 25 seeds of each of the several kinds of seeds was cut so as not to injure the germinating power. The peeled seeds were immersed in the solution indicated in Table III, and observed to note whether the solution was discolored by one more quickly than another. The embryos of 25 normal and of 25 non-viable seeds were dissected out and immersed separately from the rest of the seeds. The seeds dissected were those that did not grow.

A special point was made of determining whether or not the test was of any use with naturally colored seeds, such as papaya, red mungo, patola, etc.

RESULTS

Tables II and III show in full the results of this investigation.

Compared with the enormous number of tropical seeds, the results obtained are insignificant. Further search with other seeds would be of vital worth.

DISCUSSION OF RESULTS

The results of the experiment here reported will be briefly discussed, and only a very general interpretation will be attempted.

VIABILITY OF SEEDS AS REVEALED BY POTASSIUM HYDROXIDE SOLUTION (TABLE II)

Table I shows that there were fourteen kinds of seeds tested. Nearly all the kinds of seed investigated have considerable economic value, many of them constituting the most important crops of the Philippine Islands. Among the samples were a number of seeds which were non-viable from various causes—immaturity, decay or mechanical injury. The potassium hydroxide test, though indicating the correct percentage of seeds capable of germinating in such cases, failed with certain other kinds (see Table II), as Lesage has also pointed out.

There were two classes of seeds considered in this investigation; namely, (a) seeds not naturally colored, and (b) naturally colored seeds. Seeds not naturally colored are those whose external appearance is nearly colorless, such as rice, white corn, gray patani, squash, etc.; seeds naturally colored are those whose external appearance is colored, as red mungo, patani, patola, papaya, etc.

It was observed that a dead seed belonging to the first class (seeds not naturally colored) was discolored either in all of its parts, or only a part, but the embryo was always discolored. That is, in dead seeds of this class, the color was not the same as it would be if they were viable. This phenomenon was observed in the color test, (see Table III). The color of dead seed was found to vary from slight yellow to dark brown. The best example was corn, especially if the kernels were killed by the effect of excessive moisture. Munn corroborates this with the observation that the germs of corn kernels injured by freezing were amber colored, while the germs of good kernels were white. Immature seeds were often non-viable and were found after a certain length of time to be discolored. Another cause of death and discoloration of seeds was mechanical injury, as by the attack of weevils and other worms or insects. There were, therefore, three causes of death and discoloration of seeds noted by the writer: (a) excessive moisture; (b) harvesting before maturity was attained; and (c) mechanical injury. It was also noted that dead seeds that were discolored in these ways were responsible for the discoloration of the potassium hydroxide solutions. Other possible causes of non-viability are heat injury and old age, but such seeds were not available and so were not investigated.

The seeds that discolored the potassium hydroxide solutions, provided such seeds belonged to the first class (seeds not naturally colored) were known to be not viable. This is confirmed by Lesage, who reports "that non-viable seed was found to discolor the solution within a few hours."

In this work, the seeds found to discolor the potassium hydroxide solutions were discovered to be non-viable, because, generally, they did not grow when they were germinated. The test, however, should not be advocated as indicating the exact percentage of germination because sometimes seeds were found to germinate, although they had discolored the solution. Very few such seeds, however, were found. The alteration of color in such a case was due to the discolored skin, or to internal parts, except the embryo. When the embryo was abnormal and discolored, it was very certain that the seed was non-viable.

With the naked eye alone, it is not possible to detect the death of the embryo inside the seed if the external parts are normal, except by dissecting the seed. But the defect of the germ is easily revealed by the alteration of the color of the potassium hydroxide. This advantage shows the superiority of this method of testing viability of seeds. Another advantage of the method is the rapidity and ease with which it is performed.

Table II makes clear that the test was applicable only to the seeds that were unnaturally colored; namely, (a) rice (Dinalaga) *Oryza sativa* L.; (b) rice (Kinandang Kinapal) *Oryza sativa* L.; (c) corn (Moro) *Zea Mays* L.; (d) squash (round) *Cucurbita maxima* Duchesne; (e) Tapilan (brown mungo) *Phaseolus calaratus* Roxb.; (f) lima bean (gray) *Phaseolus lunatus* L. There are two important things to be considered in the discussion of these seeds; namely, (a) the length of time required for testing their viability, (b) the normality of the solution to be used. It was because of these conditions that the strength of the potassium hydroxide solution had to be varied, and the number of seeds that discolored the solutions observed at thirty minutes interval for three hours. It was observed that these two conditions were found to vary in the different kinds of seeds.

It is shown in Table II that the viability of the two varieties of rice investigated may be tested by 0.2 N and 0.3 N solutions for Dinalaga and Kinandang Kinapal respectively. Three hours were devoted to each of them. This may be explained by the fact that the control test of the variety Dinalaga showed 91 per cent germination, and in three hours in 0.2 N solution the number of seeds that discolored the solution and those that did not were 7 and 93 respectively. The percentage of germination of such seeds was 1 for the ones that discolored and 88 for the ones that did not. This percentage was approximately 91, the same found in the control. Therefore in testing the viability of the seeds of the variety Dinalaga, 0.2 N solution and 3 hours should be used. With variety, Kinandang Kinapal, in 0.3 N solution in 3 hours, 10 seeds discolored the solution, and 90 seeds did not. When these seeds germinated, zero out of the ten grew and all the 90 seeds which did not discolor the solution grew. This percentage was about the same as the control, 89 per cent.

It was discovered that 0.2 N solution for three hours was a good test for corn (*Zea Mays* L.), variety Moro. Ninety-seven seeds did not discolor the solution, three seeds did. When these seeds were germinated only one of the seeds that discolored the solution grew, while all the seeds that did not discolor it grew. Since 97 per cent was exactly the same as the number that grew in the control, the test was correct.

For the squash (*Cucurbita maxima* Duchesne), round variety, 0.3 N or 0.4 N in three hours was the test, with 0.4 N solution preferable. At this normality and length of time, 93 seeds discolored the solution, and 7 did not. Germination test of these seeds showed that all the 7 seeds grew and none of the 93. The test was correct, therefore reliable as 8 per cent was the result of the control.

The test for the tapilan (*Phaseolus calcaratus* Roxb.) variety, brown mungo, was found to be 0.025 N solution in 3 hours, as 28 seeds were found to discolor the solution, while 72 seeds were not. When the seeds were germinated, only 5 of the 28 grew and 64 of the 72. The percentage was 64 per cent and the control 79. The error in this case was due to the mixture of the seeds. There were some impurities.

For lima bean (*Phaseolus lunatus* L.), gray variety, 0.05 N solution in thirty minutes was the test. At this normality and time, 23 seeds discolored the solution, and 77 did not. The percentage of germination of the seeds was 1 of the 23 and 75 of the 77. The percentage was 75, with 76 for the control.

In this work it was clearly shown that the viability test by potassium hydroxide does not apply to the naturally colored seeds; namely, (a) red mungo (red tapilan) (*Phaseolus calcaratus* Roxb.); (b) McCall bean (*Phaseolus calcaratus* Roxb.); (c) lima bean (red) (*Phaseolus lunatus* L.); (d) patola (*Luffa acutangula* Roxb.); (e) calamismis, (*Psophocarpus tetragonolobus* L.); (f) papaya (Solo) (*Carica papaya* L.); (g) sincamas (*Pachyrrhizus erosus* L.); and (h) sitao (*Vigna sesquipedalis* L.). Many of the representative samples of these seeds were observed to discolor the potassium hydroxide solutions, although they were viable. The red mungo (*Phaseolus calcaratus* Roxb.) most distinctly showed such result. At 0.025 N solution in 3 hours, 93 seeds discolored the solution and only 10 seeds did not discolor it. When these seeds were germinated, 9 out of the 10, and 83 out of the 90 seeds grew. This showed a negative result, as the seeds, supposed to be non-viable because they discolored the solution, grew. This was exactly

the opposite of the desired result. The same was true with the other naturally colored seeds, except calamismis and sincamas. These two were found to have no result in germination test, but they discolored the solution the same as the others. In the case of sincamas, not a single seed grew in the control, but calamismis had 3 per cent germination. This shows that the seeds were non-viable before they were tested; it was observed that the sincamas seeds were immature.

It was suspected that in some instances many of the seeds as rice and corn were not capable of discoloring the solutions from 0.025 N to 0.1 N, because these solutions were not able to affect the seeds. But in general the higher the normality of the solutions, the greater the number of seeds which did not germinate when sown after soaking them in the solutions. This showed that the potassium hydroxide solutions killed many of the seeds. This was a general observation among the naturally colored seeds and some of the not naturally colored ones. The probable cause of this effect was the corrosive effect of the potash.

PARTS RESPONSIBLE FOR THE DISCOLORATION OF THE POTASSIUM HYDROXIDE SOLUTIONS (TABLE III)

Table III shows very clearly the parts of the seeds which were responsible for the discoloration of the solutions. It was discovered that the parts varied greatly in different kinds of seeds tested. The variation was from the seed coat to the embryo. In all the seeds used in the experiment, except red mungo (*Phaseolus calcaratus* Roxb.); patola (*Luffa acutangula* Roxb.); and papaya (*Carica papaya* L.), it was observed that the embryo of the non-viable seeds was the part responsible for the discoloration. But in the case of the viable seeds, the embryo was never found to be responsible for the alteration of the color of the solutions.

In the case of red mungo and patola only the skin was responsible for the discoloration of the solution, while all the parts of the papaya, except the embryo, discolored the solution. Discoloration of the potassium hydroxide by such parts, alone, was not enough indication for non-viability of seeds, because non-viability was proved by the result of the germination test of these seeds, shown in Table II. Therefore unless the embryo was responsible for the discoloration of the solution, the seed was viable. This interpretation was correct, because there were instances of the viable seeds in which the other parts including the skin, discolored the potassium hydroxide. The best examples were squash, sitao, lima bean, etc.

The color of the discolored potassium hydroxide solutions was found to be variable, but was generally yellow or brown. These colors resemble the color of non-viable seeds, which were slight yellow and dark brown. Slight yellow (amber color) was reported by Munn to be the indication of dead corn kernels, the result of freezing.

SUMMARY

1. Potassium hydroxide is a practical test reagent for the viability of some tropical seeds, such as rice (Dinalaga), *Oryza sativa* L.; rice (Kinandang Kinapal), *Oryza sativa* L.; corn (Moro) *Zea Mays* L.; squash (round) *Cucurbita maxima* Duchesne; tapila (brown mungo) *Phaseolus calcaratus* Roxb.; and lima bean (gray) *Phaseolus lunatus* L.

2. The normality and time required to test viability vary for the different kinds of seeds as shown by the following:

(a) Rice (Dinalaga) *Oryza sativa*, L. 0.2 N sol.; 3 hours.

(b) Rice (Kinandang Kinapal) *Oryza sativa* L. 0.3 N sol.; 3 hours.

(c) Corn (Moro) *Zea Mays* L.—0.2 N sol.; 3 hours.

(d) Squash (round) *Cucurbita maxima* Duchesne—0.4 N sol.; 3 hours.

(e) Tapilan (brown mungo) *Phaseolus calcaratus* Roxb. 0.025 N sol.; 3 hours.

(f) Lima bean (gray) *Phaseolus lunatus* L. 0.05 N sol.; 0.5 hour.

3. The viability test by potassium hydroxide solutions does not apply to naturally colored seeds; namely, sitao, *Vigna sesquipedalis* L.; red mungo, *Phaseolus calcaratus* Roxb; McCall bean *Phaseolus calcaratus* Roxb.; lima bean (red), *Phaseolus lunatus* L.; patola, *Luffa acutangula* Roxb.; calamismis, *Psophocarpus tetragonolobus* L., papaya, *Carica papaya* L.; and sincamas, *Pachyrrhizus erosus* L.

4. In the case of dead seeds the embryo is the chief part responsible for the discoloration of the solution, while the embryo of the viable seed does not cause discoloration.

5. If the skin alone discolors the solution, the discoloration is not sufficient indication of the non-viability of the seed.

6. The most common color of the discolored potassium hydroxide solutions is yellow or brown.

7. The color of dead seeds is either amber or dark brown, or a combination of both.

8. The strength of the potassium hydroxide affects the seeds, and in many instances, kills them.

9. Seeds, having a rigid, hard, and colorless skin are hardly affected by low normality of potassium hydroxide; such seeds need higher normality for their test.

10. The number of seeds that germinate after soaking them in solutions decreases as the normality increases, provided such normality is higher than the one already proved to be the test.

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TABLE I.—*The kind of seed used, their college number and age.*

No.	Common name.	Variety name.	Scientific name.	Family name.	College number.	Age.
1	Rice	Dinalaga	*Oryza sativa* L.	Gramineæ	7335	2 months
2	Rice	Kinandang Kinapal	*Oryza sativa* L.	Gramineæ	9049	2 months
3	Corn	Moro	*Zea Mays* L.	Gramineæ	9440	2 months
4	Squash	Round	*Cucurbita maxima* Duchesne	Cucurbitaceæ	*a*	8 months
5	Sitao		*Vigna sesquipadalis* L.	Leguminosæ	17991	4 months
6	Tapilan	Brown mungo	*Phaseolus calcaratus* Roxb.	Leguminosæ	295	1 year
7	Lima bean	Gray	*Phaseolus lunatus* L.	Leguminosæ	17987	9 months
8	Red mungo	Red tapilan	*Phaseolus calcaratus* Roxb.	Leguminosæ	$281F_2$	1 year
9	McCall bean		*Phaseolus calcaratus* Roxb.	Leguminosæ	none	1 year
10	Lima bean	Red	*Phaseolus lunatus* L.	Leguminosæ	*a*	10 months
11	Patola	Medium size Patola	*Luffa acutangula* Roxb	Cucurbitaceæ	17584	3 months
12	Calamismis		*Psophocarpus tetragonolubus* L.	Leguminosæ	16993	1 year 2 months
13	Papaya	Solo	*Carica papaya* L.	Caricaceæ	$12163F_3$	1 year
14	Sincamas		*Pachyrrhizus erosus* L.	Leguminosæ	17995	11 months

a Not College seed.

TABLE II.—*Germination test and observation of the number of seeds that discolored the potassium hydroxide (KOH) solution.*

Kind of seed.	Control. No. of seeds germinated.	Normality of KOH solution.	Observation of the No. of seeds that discolored the KOH solution 30 minutes interval.						Total No. of seeds that discolored the KOH solution.	Total No. of seeds that did not discolor the KOH solution.	No. of seeds germinated after soaking them in KOH solution.	
			1st.	2nd.	3rd.	4th.	5th.	6th.			Seeds that discolored the solution.	Seeds that did not discolor the solution.
Rice (Dinalaga)	91 (91%)	*N*										
		0.025	0	0	0	0	0	0	0	100	0	90
		0.05	0	0	0	0	0	0	0	100	0	93
		0.1	0	0	0	0	0	0	0	100	0	92
		0.2	0	0	0	0	5	2	7	93	1	88
		0.3	0	0	0	0	6	14	20	80	4	73
		0.4	0	0	0	0	2	30	32	68	2	66
Rice (Kinandang Kinapal)	89 (89%)	0.025	0	0	0	0	0	0	0	100	0	92
		0.05	0	0	0	0	0	0	0	100	0	92
		0.1	0	0	0	0	0	0	0	100	0	91
		0.2	0	0	0	0	0	12	12	88	5	84
		0.3	0	0	0	0	4	6	10	90	0	90
		0.4	0	0	0	0	2	16	18	82	4	80
Corn (Moro)	97 (97%)	0.025	0	0	0	0	0	0	0	100	0	98
		0.05	0	0	0	0	0	0	0	100	0	95
		0.1	0	0	0	0	0	0	0	100	0	95
		0.2	0	0	0	0	1	2	3	97	1	97
		0.3	0	0	0	0	4	21	25	75	6	72
		0.4	0	0	0	2	8	42	52	48	3	44
Squash (round)	8 (8%)	0.025	32	16	6	14	10	0	78	22	0	7
		0.05	21	31	14	15	3	0	84	16	0	5
		0.1	33	10	11	16	2	0	72	28	0	8
		0.2	31	15	24	15	3	0	88	12	0	7
		0.3	29	13	37	29	4	2	94	6	0	6
		0.4	35	14	32	8	3	1	93	7	0	7
Sitao	76 (76%)	0.025	20	7	6	2	3	26	64	36	28	35
		0.05	40	40	1	2	1	4	88	12	49	12
		0.1	86	13	1	—	—	—	100	0	54	0
		0.2	88	8	4	—	—	—	100	0	43	0
		0.3	85	14	1	—	—	—	100	0	27	0
		0.4	78	17	5	—	—	—	100	0	2	0
		0.025	0	0	0	4	16	8	28	72	5	64
		0.05	8	4	12	12	24	16	76	24	6	14

Lima bean (gray)	76 (76%)	0.05	23	0	0	0	0	0	23	77	3	75
		0.1	10	5	14	14	6	0	49	51	6	30
		0.2	10	4	8	8	4	0	34	66	5	20
		0.3	12	0	16	17	10	0	45	55	7	20
		0.4	28	0	15	18	0	0	61	39	0	0
Red mungo (red tapilan)	94 (94%)	0.025	5	2	6	55	19	3	90	10	83	9
		0.05	4	3	13	57	19	0	96	4	60	3
		0.1	5	9	62	17	5	0	98	2	59	2
		0.2	6	16	51	20	4	1	98	2	38	2
		0.3	4	11	57	21	6	0	99	1	18	0
		0.4	3	2	75	13	7	—	100	0	33	0
McCall bean	12 (12%)	0.025	8	12	8	32	16	4	80	20	8	1
		0.05	8	16	32	50	0	0	96	4	7	0
		0.1	12	20	64	4	—	—	100	0	9	0
		0.2	8	32	56	4	—	—	100	0	11	0
		0.3	16	44	40	—	—	—	100	0	5	0
		0.4	12	32	48	8	—	—	100	0	2	0
Lima bean (red)	60 (60%)	0.025	15	10	3	5	8	13	54	46	38	20
		0.05	10	5	11	0	0	16	42	58	34	25
		0.1	11	6	12	5	5	24	63	37	40	10
		0.2	14	5	5	17	6	25	72	28	45	5
		0.3	13	5	0	8	16	23	65	35	12	1
		0.4	12	8	4	8	12	44	86	14	7	0
Patola	55 (55%)	0.025	40	51	9	—	—	—	100	0	50	0
		0.05	91	6	3	—	—	—	100	0	49	0
		0.1	95	4	1	—	—	—	100	0	51	0
		0.2	89	11	—	—	—	—	100	0	54	0
		0.3	96	4	—	—	—	—	100	0	56	0
		0.4	100	—	—	—	—	—	100	0	19	0
Calamismis	3 (3%)	0.025	4	2	2	8	7	1	24	76	0	0
		0.05	1	5	6	10	8	3	33	67	0	0
		0.1	10	11	8	7	4	0	40	60	0	0
		0.2	6	8	10	9	3	0	36	64	0	0
		0.3	5	10	11	6	4	0	36	64	0	0
		0.4	16	10	7	8	2	0	43	57	0	0
Papaya (Solo)	48 (48%)	0.025	24	20	10	25	10	0	89	11	33	8
		0.05	45	21	20	10	4	—	100	0	20	0
		0.1	37	13	30	20	—	—	100	0	35	0
		0.2	31	22	35	12	—	—	100	0	46	0
		0.3	48	10	36	6	—	—	100	0	25	0
		0.4	53	47	—	—	—	—	100	0	20	0
Sincamas	None (0%)	0.025	55	16	2	5	7	6	91	9	0	0
		0.05	59	8	10	7	8	2	94	6	0	0
		0.1	70	6	7	4	6	3	96	4	0	0
		0.2	47	23	16	7	5	1	99	1	0	0
		0.3	57	17	13	7	1	0	95	5	0	0
		0.4	68	15	9	8	—	—	100	0	0	0

TABLE III.—*Results of color test.*

Kind of seed.	Normality of KOH solution.	Natural color of seeds. Seed coat not removed.	Color of KOH solution after seeds are soaked. Skin not removed.	Color of KOH solution when seeds are soaked after removal of skin.	Color of KOH solution if embryo is dissected.			
					Viable seeds.		Dead seeds.	
					Embryo.	Other parts.	Embryo.	Other parts.
Rice (Dinalaga).....	*N* 0.2	white	yellow	very pale yellow	none	none	pale yellow	none
Rice (Kinandang kinapal).....	0.3	white	yellow	none	none	none	dark white	none
Corn (Moro).....	0.2	white	yellow	none	none	none	yellow	brownish yellow
Squash (round).....	0.3	pale yellow	red	none	none	pale yellow	pale yellow	yellow
Sitao.....	0.025	white with red spot	intense yellow	yellow	none	none	yellow	dark yellow
Tapilan (brown mungo).....	0.025	whitish brown	yellow	yellow	none	pale yellow	gold yellow	dark yellow
Lima bean (gray)....	0.05	gray	red	brownish yellow	none	none	yellow	dark yellow
Red mungo (red tapilan).....	0.2	red	yellow	none	none	pale yellow	gold yellow	brownish yellow
McCall bean.....	0.1	red	yellow	gold color	none	none	none	none
Lima bean (red).....	0.4	red	reddish black	brownish yellow	none	yellow	pale yellow	gold yellow
Patola.....	0.3	black	brownish yellow	none	none	pale brown	reddish yellow	brown
Calamismis.....	0.4	reddish black	red	yellow	none	none	none	none
Papaya (Solo).....	0.4	pale black	reddish black	none	none	yellow	pale yellow	pale brown
Sincamas.....	0.4	red	yellow	yellow	none	yellow	pale yellow	yellow

ABSTRACT[1]

The growth and yield of sweet potato started from different cuttings, Damaso O. Roque (*Thesis presented for graduation from the College of Agriculture No. 187; Experiment Station contribution No. 238*).—The Philippine farmer uses camote cuttings taken from different portions of the vine for planting. In some cases cuttings from the sprouting tubers are used.

The author tried to find out the relation between growth and yield of the plants grown from different cuttings of camote under existing field conditions in Los Baños. The different cuttings were planted in lots having as like conditions as practicable.

It was found that the tip cuttings gave the fastest growth and the highest yield while the base cuttings gave the reverse; that the sprouted tubers grew faster and yielded more than the unsprouted ones; and that in general, the cuttings are more advantageous to plant than the tubers, as they give more yield and grow faster. The comparative average weekly growths in centimeters were 202.98 for tip cuttings; 104.48 for middle cuttings; 74.77 for base cuttings; 91.74 for sprouted tubers; and 67.35 for unsprouted tubers. The corresponding yield of these different cuttings in kilograms were: 147.8, 124.0, 108.2, 116.8, and 59.9.

—*Abstract by Felix M. Esguerra.*

[1] Abstract prepared for partial fulfillment of the work required in English 101.

EXCHANGE NOTES

Our nation (U. S. A.) was established by one-man enterprise—the one-man farm whose products fed and clothed the family; the one-man store, blacksmith shop, stage coach; the one-man mail service. What distinguishes the nation today is the fruit of associated, or organized effort. Transportation, communication, manufacture, merchandizing are all conducted by great groups, often of thousands of individuals, each with its leadership of superior ability—leadership which has been earned by the survival of the fittest in years of competition. Associated effort standardizes products, rewards quality, penalizes inefficiency. The economies effected often increase the returns sufficiently to change failure into financial success for the year's effort.—H. E. Van Norman.

—*World Agriculture.*

The United States Corn Belt, the world's greatest food-producing area, is threatened by an advance of a European insect army. To meet the menace of the invading corn borers at the frontier, eighty entomologists, agronomists and country farm agents from Illinois, Indiana, Ohio and the Federal Government will officer a great offensive along a wide front in northern Ohio, according to war plans outlined recently by Professor George A. Dean, of the U. S. Bureau of Entomology.

An expert will be placed in every township of the infested area and some 20,000 farms will be visited to show farmers how to check the spread of the insects by destruction of the remnants of last year's crops.

Entomologists at the United States laboratory at Hyeres, near Marseilles, France, have discovered a parasite known as *Exeristes roborator*, which may prove an effective ally in checking the further spread of the borers. Fifty thousand of these insect foes of the corn-borer will be released this summer in the infested areas of Ohio and New York.

The European corn-borer entered America very probably in broom corn shipped from Italy or Hungary.

—*Science.*

It is planned to assemble in the new section, (Genetics), the more fundamental studies of variations, cytology as the physical basis of heredity, Mendelism, quantitative and blending inheritance, linkage and crossing over, sex determination and secondary sex characters, the inheritance of acquired characters, radical crosses, selection and pure lines, and breeding methods. The growing importance of genetics as a distinct field of research will thus be recognized, and it is hoped that the needs of geneticists will be so much more conveniently met as to warrant the departure from the previous classification.

—*Experiment Station Record.*

No one doubts that our national life would be the poorer by a decline in our rural life. History and literature and art have shown throughout the ages that daily contact with the elemental forces of nature breeds independence of character, virility of mind, constancy of purpose—qualities included among those accounted worth while in life. And if perchance at times these are allied with other and less desirable accompaniments, the latter, more often than not, are attributable to causes which a well-organized national life could remove or control.—JOHN STRONG, Professor of Education, Leeds University.

—The *Agricultural Gazette*, N. S. W.

The recently issued annual Report of Rockefeller Foundation tells of assisting in rebuilding and re-organizing medical schools at Sao Paulo, Brazil, and Bangkok in Siam, and supplying laboratory equipment to medical institutions in Austria, Czechslovakia, Hungary and Switzerland. Assistance as a result of a recent survey of institutions in Europe undertaken in 1922 is being extended to Germany and Poland. Equipment of all kinds as well as stipends have been given to teachers and investigators of the Pasteur Institute of Paris and other European centres while two million dollars have been given toward the site, building and equipment of a school of hygiene in London (opened in August, 1923). Demonstrations in malaria control have been carried on in the Southern United States, Porto Rico, Nicaragua, Brazil, Palestine, Australia, and the Philippines.

—*Tropical Agriculture.*

I would strongly advise poultrymen never to place at the head of their breeding pen a male bird the mother of which laid eggs of less than two ounces and never to incubate an egg that does not weigh two ounces. This is, I am sure, the only way by which the size of eggs laid by a flock will be increased.

A very important thing to remember is that the best and strongest chickens are hatched from the first twenty or thirty eggs that a hen lays after her moult.

—The *Journal of the Department of Agriculture*,
Victoria Australia.

The dairy industry has moved up in the social scale, when the President of the United States, three Cabinet officers, and the leading daily papers throughout the United States recognize it, and give up their time to meet its leaders and discuss its relation to national welfare.—PRESIDENT VAN NORMAN'S Report of the World Dairy Congress.

—*World Agriculture.*

COLLEGE AND ALUMNI NOTES

Dr. Otto A. Reinking, formerly professor of plant pathology and head of the department in the College of Agriculture and now pathologist for the United Fruit Company stationed in Tela, Honduras, in a letter to Dr. G. O. Ocfemia says: "I would like to hear from you quite often as I am still very much interested in the work going on in the Philippines."

According to a reliable source of information the Bureau of Plant Industry of the United States Department of Agriculture at Washington, D. C., is planning to send Doctor Reinking to the Philippines to study the heart rot of abaca.

Dr. C. M. Tucker, plant pathologist to the Porto Rico Agricultural Experiment Station, at Mayaguez, Porto Rico, wrote to Dr. G. O. Ocfemia that a bud rot of the coconut palm has appeared in Porto Rico similar to the bud rot studied by Doctor Reinking in the Philippines. Doctor Tucker has isolated a Phytophthora which differs in some details from the *Phytophthora faberi* found by Doctor Reinking. Doctor Tucker has asked for a culture of the *P. faberi* from coconut in the Philippines for comparison with his culture. This is of great interest because it tends to show that the bud rot of coconut occurring in different regions of the world is caused by either the same species or of very closely related species of fungus of the genus Phytophthora.

The following notes about the work of Mr. Joaquin Gonzalez, B. Agr. '19, should interest other graduates.

Since Mr. Gonzalez graduated from this College more than five years ago, he has been in charge as field manager of a farm of about 4000 hectares in Apalit, Pampanga. He has also been renting for himself another farm containing about 110 hectares of land. When he got this land he wanted to plant sugar cane but not having the facilities he decided to use rice as a stepping stone. He planted rice in June, 1920, and in December of the same year he had a very good harvest which called for favorable comments from the common farmers in his vicinity. He got so much profit from this first year's venture that in the following year he was able to begin his plan of sugar cane farming. From his first year's sugar cane crop he obtained over 400 piculs of centrifugal sugar. This result encouraged him to the extent of leasing another farm on a fifty-fifty basis, and planting this land also to sugar cane. In 1922 he obtained as his share alone 1500 piculs of centrifugal sugar. With this harvest he was able to pay all his debts and have several thousands of pesos surplus. In 1923 there was a flood in Pampanga and, as happened to other sugar cane farmers, Mr. Gonzalez' crop was badly damaged. Desiring to play safe, he bought, with what money he had left, a six-roomed house in Manila. This house is now bringing him a monthly income of ₱230. At present Mr. Gonzalez is running also a jewelry business so that now, besides being a rice and sugar cane farmer, he is in other business ventures.

Like other successful men, Mr. Gonzalez went out of the College and began farming fully conscious of his shortcomings and lack of experience. For example as regards his first year as a field superintendent of the 4000 hectare farm, he writes: "Believe me this was the most trying year I ever had in my life, for while the public looked upon me as a graduate in agriculture and one from whom much is therefore expected, I felt that I had yet very much to learn from the book of nature and from my very *inquilinas* who were working under me. I worked hard, morning and afternoon, and it took me almost a year before I felt confident that I could do something as a farmer."

Mr. Gonzalez is a co-operator of the Plant Breeding Division of this College. For a time, he was multiplying selected rice strains coming from the College of Agriculture. At present, he has on his sugar cane farm, under multiplication, several seedling varieties of sugar cane raised also in this College. While farming, Mr. Gonzalez is also running experiments calculated to improve his methods of work. As a result of these experiments he has discovered several facts which should be of interest to farmers in Apalit, Pampanga, and which serve to confirm the observations of other men. According to him, the best planting months in Apalit are November, December, and January, December being the best of the three; the best time to harvest being from the latter part of December to the end of January. He condemns the practice of many sugar cane growers of sticking the cane points in the furrows without regard to the position of the buds. He claims it is best to place the point in such a way that the buds are on both lateral sides of the point instead of on the top and under side. If planted in the wrong way only the top buds develop while those below practically become useless. This matter should be doubly important to farmers of Pampanga where it is the common practice to pass a bamboo harrow over the young cane plants two or three times in the life time of the crop to break the plant and induce a heavier stooling. He recommends that in laying the furrows, they should be in the direction of the wind and that the points be laid obliquely with the top end pointing away from the source of the wind. He says that planted this way, the plants to grow from the points are less subject to wind injuries than otherwise.

Mr. Alejo Jimenez, B. Agr. '21, B. S. '23, and Mr. Elias Caray, B. Agr. '21, M. S. '24, resigned from their positions as assistants in chemistry. Mr. Jimenez returns to the family farm at Lopez, Tayabas, where he will engage in *scientific* farming. Mr. Caray will teach in the Batangas High School.

THE COLLEGE OF AGRICULTURE IN 1921 AS SEEN FROM THE AIR